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THESIS

INPUT AND TRACKING OF CONTINUED EDUCATION UNITS AND QUALIFICATION DATA FOR THE INFORMATION PROFESSIONAL (IP) COMMUNITY

by

LaShandra M. Beard

September 2004

Thesis Advisor:	Dan C. Boger
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The objective of this research is to provide recommendations and guidelines for building and maintaining a comprehensive Continuing Education Units (CEU) and qualification tracking system specifically for the Continuing Education Units (CEU) and Qualification program. The guidance includes topics ranging from designing, managing, and implementing a tracking program, through post-implementation of the program. This research includes the training needs of all personnel within the IP community, from users to supervisors to executive-level mangers extending to include designated sponsors/mentors and external subject matter experts.

The key research focus of this thesis is to examine the risk and cost benefits in automating the training record for the Information Professional community and further discuss interface design issues and considerations to maximize the flexibility and functionality provided by automation.

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INPUT AND TRACKING OF CONTINUED EDUCATION UNIT AND QUALIFICATION DATA FOR INFORMATION PROFESSIONAL (IP) COMMUNITY

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Submitted in partial fulfillment of the
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ABSTRACT

The objective of this research is to provide recommendations and guidelines for building and maintaining a comprehensive Continuing Education Units (CEU) and qualification tracking system for the Information Professional (IP) community. The guidance includes topics ranging from designing, managing, and implementing a tracking program, through post-implementation of the program. This research includes the training needs of all personnel within the IP community, from users to supervisors to executive-level mangers extending to include designated sponsors/mentors and external subject matter experts.

The key research focus of this thesis is to examine the risk and cost benefits in automating the training record for the Information Professional community and further discuss interface design issues and considerations to maximize the flexibility and functionality provided by automation.

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LIST OF ACRONYMS AND ABBREVIATIONS

5VM	Five Vector Model
AQ	Advanced Qualification
BQ	Basic Qualification
CEU	Continuing Education Unit
CMC	Command Master Chief
COMFLTFORCOM	Commander, U.S. Fleet Forces Command
DH	Department Head
DIMHRS	Defense Integrated Military Human Resources System
DIVO	Division Officer
DL	Distance Learning
DoD	Department of Defense
EMPRS	Electronic Personnel Record System
FAQ	Functional Area Qualification
FRS	Fleet Replacement Squadrons
HTML	Hypertext Transport Protocol
ILE	Integrated Learning Environment
IIOP	Inter-ORB Protocol
IP	Information Professional
IPCOE	Information Professional Center of Excellence
IQ	Intermediate Qualification
JNDI	Java Naming and Directory Interface
LAN	Local Area Network
LCMS	Learning Content Management System
LCPO	Leading Chief Petty Officer
LMS	Learning Management System
LPO	Leading Petty Officer
NAVNETWARCOM	Commander, Naval Network Warfare Command
NEC	Navy Enlisted Classification
NFO	Navy Flight Officer
NKO	Navy Knowledge Online

NMCI	Navy and Marine Corp Intranet
NPC	Navy Personnel Command
NPTU	Nuclear Power Training Unit
NROTC	Navy Reserve Officer Training Corps
NSIPS	Navy Standard Integrated Personnel System
NTMPS	Navy Training Management & Planning System
ODC	Officer Data Card
OFSR	Officer Field Service Record
PSR	Personnel Summary Report
RMI	Remote Method Invocation
SIHRS	Single Integrated Human Resources
SME	Subject Matter Expert
SOAP	Simple Object Access Protocol
SSN	Social Security Number
TCP/IP	Transmission Control Protocol/Internet Protocol
URL	Uniform Resource Locator
USNA	United States Navy Academy
W3C	World Wide Web Consortium
WSDL	Web Services Description Language
WWW	World Wide Web
XML	Extensible Markup Language

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EXECUTIVE SUMMARY

Per NAVADMIN 229/00, dated 311606Z AUG 00, the requirement for PSD/personnel offices to maintain Officer Field Service Records (OFSR) for active duty and reserve officers was eliminated. Service members have always been charged with the responsibility of keeping their permanent personnel records up-to-date; however, with the elimination of the OFSR, this responsibility is even greater. To better keep track of changes, officers have been tasked with ordering and reviewing their Permanent Personnel Record (Microfiche), Performance Summary Report (PSR), and Officer Data Card (ODC). **[ADMIN]**

The Navy has been working on various ways to improve the process of building and maintaining a sailor's career. To date, the Navy's solution is the Five Vector Model (5VM). Although this tool is mainly focused on the enlisted ratings, the goal is that the 5VM will soon be the primary career management tool for all sailors and will play a critical role in the Sea Warrior process, including tools for managing individual professional/personal growth and development, the distribution process, learning opportunities and delivery of knowledge, and ultimately will lead to improved fleet readiness. Currently accessed through Navy Knowledge Online (www.nko.navy.mil), sailors are able to determine their professional status dynamically, pinpoint career milestones, and identify the skill requirements needed for increasing their personal and professional development as well as those for preparing for specific jobs in the fleet. Additionally, the 5VM model will allow sailors to review and compare their own and alternate career paths, their electronic training jacket, and it will allow them to enroll in online courses of instruction that will satisfy existing training requirements for billets throughout the fleet. Phasing and testing of various components of the 5VM are currently underway. However, as a whole, this process has yet to be implemented.

Communities like the Information Professionals rely heavily on obtaining and maintaining their technical knowledge. With the absence of the hard copy service record, the ability to track and ensure that individuals are receiving required education and training is essential in today's highly networked systems environment.

With the aid of web-based technology, the roll-out plan is to propose an automated mechanism (web-based, secure environment) for data entry and tracking of IP certification and qualification data. Every component utilized for the development, management, and implementation for the automated tracking system must align within the Sea Warrior architecture.

I. INTRODUCTION

A. BACKGROUND

This thesis will cover the requirements for designing, implementing, and maintaining a centralized qualification tracking tool. It must effectively track and manage Continued Education Units and qualifications for the IP community.

B. OBJECTIVES

The goal of this thesis is to assess the ability of the Navy, or more specifically, the Information Professional (IP) Community to transition successfully from a paper driven professional development and qualifications record system to an electronic environment while maintaining accuracy and the record's integrity. The thesis will concentrate its efforts on the Education Tracking Field of the record. A critical sub-objective is to evaluate the Continued Education Unit (CEU) and Qualification process currently used by the IP community.

It will also touch on implementation design and desired functionality of the application program as well as network implementation strategies and risk management considerations.

C. RESEARCH QUESTION

What are the requirements, necessary concepts, and applications needed to develop a web-based tool to track and facilitate IP officer qualifications and CEU requirements?

D. SCOPE

The scope will include:

- Identify current and future training objectives;
- Define required processes;
- Establish sources of training that will fulfill requirements;
- Promote education and training initiatives.

E. METHODOLOGY

Information collected in this study includes a literature review of books, professional journals, magazine articles, web-based materials, and other library information sources.

A major portion of the research material was obtained from U.S. Fleet Forces Command (COMFLTFORCOM) and Naval Network Warfare Command (NAVNETWARCOM). Comprehensive literature from the Navy Standard Integrated Personnel System (NSIPS) is utilized to determine how to develop a web-based, secure environment, automated mechanism for data entry and tracking IP CEU and qualification data. Also, interviews with NETWARCOM personnel are utilized to determine a baseline for compliance for the IP community and possibly other communities.

F. ORGANIZATION OF THE THESIS

Chapter II discusses the operating procedures and system functionality for the training module. This chapter includes a description of:

- Evaluation of the CEU and qualification process
- Evaluation of the community training needs
- Evolution toward a web-enabled environment.

Chapter III gives an overview of what the user interface will require. This chapter suggests considerations for the design of the application program, including desired functionality and future capabilities. Risk management and a cost analysis of producing such a system will also be discussed.

System analysis and design procedures employed in integrating the training module with the Electronic Military Personnel Record System (EMPRS), the Navy Knowledge Online (NKO), other software applications, the Navy and Marine Corp Intranet (NMCI), 5 Vector Model, and the Sea Warrior Architecture are discussed in Chapter IV.

Chapter V concludes by summarizing the research, discussing lessons learned and providing recommendations for future research.

II. DEVELOPING THE TRAINING PROGRAM STRATEGY FOR THE CEU AND QUALIFICATION PROCESS

A. OVERVIEW OF THE CEU AND QUALIFICATION PROCESS

As the inception of the IP community progresses, so has the need for some type of Information Professional Officer Qualification and Continuing Education Unit Program. Commander, Naval Network Warfare Command (NETWARCOM) and Commander, U. S. Fleet Forces Command (COMFLTFORCOM) have established such an instruction. COMFLTFORCOMINST 1520.1 implements the Information Professional (IP) Officer Qualification Program and Continuing Education Unit (CEU) Program for IP officers. NETWARCOMINST 1520.1 divides its instruction into two parts. The first part details the requirements and procedures for active duty Information Professional Officers in order to obtain IP qualification. The second part of this instruction details the Continuing Education Unit program requirements and procedures for active duty Information Professional Officers to obtain IP qualification.

1. Continuing Education Unit

The IP Continuing Education Unit Program is a recurring annual professional education requirement designed to maintain the highest levels of technical currency and further augment and support formal education for IP officers. Upon accession to the IP community, each IP officer is required to earn a specified number of CEU course credit hours at various levels of the qualification process. Depending on the current level of qualification, and the date that the IQ is finally achieved, CEUs must be completed as follows:

- Basic - 1 CEU is required
- Intermediate or above - 10 CEUs required
- If IQ is completed between Jan-Mar – 10 CEUs required
- If IQ is completed between Apr-Jun - 7 CEUs required
- If IQ is completed between Jul-Sept - 4 CEUs required
- If IQ is completed between Oct-Dec - 1 CEUs required

Table 1 provides a more generalized breakdown of the CEU credit system.

CEU	Requirement
1	One Computer Based Training course (CBT) successfully completed
1	Each 10 contact hours of instruction
1	Every 4 hours of active participation in professional association activities
2	Qualification Board Member participation
2	One industry certification exam passed
3	One symposium/conference presentation
5	One article on a related IP core competency topic published in an accepted technical, education, or military journal or magazine

Table 1. CEU Credit System. From Ref **[CEU-1]**

2. IP Qualification Program

The IP Qualification Program is a career-long learning continuum for IP officers, that includes not only individual qualifications that must be accomplished at all levels of the process, but also advanced education, formal training, individual learning opportunities and experience-based learning.

The premises of the qualification program support a three layer architecture starting with Basic Qualification (BQ), then Intermediate Qualification (IQ), and lastly, Advanced Qualification (AQ). BQ requires a broad understanding of the IP designator and mission areas, which is achieved once the member has completed an IP Basic School or Basic Qualification Package and a Basic Qualification Review Board. IQ requires an in-depth understanding of IP Core Competencies. Core competencies include communications, information systems theory and applications, databases and network fundamentals, knowledge management, afloat, ashore, joint, allied, coalition C4 systems, and infrastructure and information assurance. Completion of the Intermediate Qualification Requirements package and an Intermediate Qualification Review Board grants Intermediate Qualification. AQ requires expert understanding of enterprise level information mission/business processes. Senior level IP officers are expected to use existing capstone qualifications to prepare for this level. Upon attainment of AQ, senior IP officers should be better prepared to innovate and execute change management, strategic vision, or any mission required to capitalize on the Navy's investment in the IP community. AQ is achieved upon completion of IP Basic and Intermediate and once an individual has successfully completed four certifications/qualifications categories at the Advanced level. These categories include but are not limited to Strike Group Command

and Control, Combat Systems, Network Operations Leadership, Staff C4I, Joint Operations, Chief Information Officer, Information Assurance Officer, Certified IS Security Professional, Certified IS Auditor, and Certified Computing Professional. **[QUAL-2]**

Technical Refresher must be continued annually in order to maintain proficiency and introduce new technology to the community. There is one additional training area not yet mentioned. Functional Area Qualification (FAQ) will only be applied toward jobs identified by NETWARCOM as requiring knowledge outside of or more in depth than that provided by the IP core competencies. Completion of these qualifications will count towards Continuing Education Units.

B. EVALUATION OF THE COMMUNITY TRAINING NEEDS

1. Technological Needs

Despite becoming more popular in recent years, Web-based tools such as management systems have currently been in existence for approximately a decade now. The endorsement of the Paperwork Reduction Act of 1995, the Electronic Freedom of Information Act Amendments of 1996, the Information Technology Management Reform Act of 1996 (Clinger-Cohen Act), Presidential Executive Order 13011 of July 16, 1996, President Clinton's "Electronic Government" Memorandum, Paperwork Elimination Act of 1998 and the final elimination of the Officer Field Service Record (OFSR) in August 2000 now require the transition to an electronic human resource system.

Modern technological advances have resulted in the creation of media-rich training aids, which combine both text and graphics with the assistance of an Internet connection to provide an unlimited amount of information to an unlimited number of people internally within an organization as well as providing the means externally.

The primary research question is to determine if DoD can successfully transition to a completely electronic record environment. The intent of the U.S. Navy and the Information Professional community is to seek a solution (tool) that can be used throughout the service for officer and enlisted personnel that will track and maintain a

comprehensive training record for each individual. This will be accomplished with commercial off-the-shelf software and the expanding nature of the existing World Wide Web technology.

The automation of the OFSR into a centralized relational database will enhance record maintenance and upkeep. It will also provide standardization as well as reduced documentation errors, maintenance and repair time, and storage requirements. It will also improve portability and enhance interoperability.

2. Administrative Needs

IP training should be focused on the development of the IP community as a whole. Senior leaders must set the model for proper execution of duties to obtain qualifications and complete CEUs within the allotted time. A training program must begin with an effort that can be deployed and implemented in various ways and aimed at all ranks of the community including senior and flag officers.

With the establishment of CEU and Qualification for the IP community, the next logical step is to define the scope and essential elements to support these programs.

The majority of IP professionals agree that proficiency training is critical in order to develop IP officers with a firm foundation in the strategic environment associated not only with the Navy, but also with Joint and Coalition C4ISR. However, many naval officers seeking the specialized warfare qualification perceive training requirements as excessive but manageable at best, and simply too time consuming at worst. The military qualification process has always been difficult to complete within the compacted time schedule. However, with the focus of training moving from on-the-job training (OJT) toward web-enabled tools, such as on-line courses offered through NETg, e-learning distance learning (DL) modules, and informal modes such as participating in seminars and other professional activities, the tools to attain qualification effectively within the obligatory timeframe are available. Another important but unconsciously overlooked concern in the IP community is the need for newcomers to be able to identify with the exact requirements essential for advancing in this field. Unlike any of the major communities in the Navy such as Surface Warfare, Aviation, Submarine, Supply, Cryptology, Intelligence and even the Judge Advocate General, personnel must attend

required administrative training periods throughout one's career to be able to meet future challenges. Conversely, although all of the aforementioned communities have established training schools, these programs are firmly structured and implemented. The majority of courses taught are on-site with the exception of some web-based e-learning tools.

a. Analysis of Various Existing Training Programs

Two administrative training programs were selected for analysis in this chapter. These two schools are offered by two distinct communities: Aviation and Submarine. The analysis will include a historical background of the courses and their importance to its community. These courses and detailed information of the topics covered are discussed below. The purpose of this discussion is not to indicate that the IP community is deficient in its training requirements but to highlight additional methods that may help to achieve and maintain enhanced levels of knowledge.

(1) Aviation School. The U.S. Navy offers the world's most advanced and comprehensive aviation training to individuals who demonstrate academic and physical aptitude and a potential for leadership and responsibility.

Aviation Officer Candidate School (OCS). Naval Air Station, Pensacola, Florida is one way to access the officer Aviation pipeline. This avenue is for those with no prior military experience. Applicants must have already obtained a Bachelor's degree before being accepted. OCS's preparation is for the roles and responsibilities expected of and afforded to U.S. naval officers through academic and military courses and physical fitness training.

Graduates of the Naval Reserve Officer Training Corps (NROTC) and United Stated Naval Academy (USNA) are selected for flight training during their final year of school. All officers entering aviation programs must also complete a six–week air indoctrination course at Naval Aviation Schools Command, also in Pensacola. Prospective pilots and Naval Flight Officers (NFOs) then attend Primary flight training.

Upon completion of Primary flight training, pilots and NFOs request an aircraft training pipeline and enter the Intermediate phase of flight training, which builds upon the prerequisites of basic flight and navigation training. Advanced

naval flight training is tailored for mission specifics and upon completion, both pilots and NFOs are awarded their wings of gold and report to their respective Fleet Replacement Squadrons (FRS) for advanced flight training in their specific aircraft. [AVA]

(2) Submarine School. Midshipmen, junior officers, and OCS graduates selected for the Nuclear Propulsion Program attend the Naval Nuclear Power School in Charleston, South Carolina. This 24-week course teaches newly commissioned officers the fundamental theories involved with Navy nuclear propulsion plants. Areas of study include thermodynamics, nuclear reactor principles and dynamics, radiological fundamentals and electrical engineering. Following Nuclear Power School, officers are assigned to a shore-based reactor training facility at the Nuclear Power Training Unit (NPTU) in upstate New York or Charleston, South Carolina for 26 weeks of practical hands-on training. Students receive instruction in an operational reactor plant in order to learn to react properly to normal and casualty situations. This training qualifies officers as propulsion plant operators who obtain extensive watch standing knowledge and a thorough understanding of all propulsion plant systems. Prior to reporting to the first submarine as an officer, it is necessary to attend a 12-week Submarine Officer Basic Course in Groton, Connecticut in order to learn the ins and outs of today's advanced submarines. This course covers the theories and principles of submarine operations, tactics, organization and control, administrative responsibilities, submarine safety and weapons systems. **[SUB]**

C. EVOLUTION TOWARD A WEB-ENABLED ENVIRONMENT

The 21st century will see tremendous increases in naval connectivity, precision, and reach, ushering in a new era of joint operational effectiveness. The military services, more specifically the Navy, have been moving toward network based information operations for many years; however since September 11, 2001, gaining information superiority has become the priority. In spite of continuous thrust in the field, information technology and knowledge management have accelerated so rapidly that the military struggles to stay current. In order to grasp such an elusive concept, the need for a community specializing in such a field was created: Information Professionals.

To realize the opportunities and navigate the challenges ahead, the Information Professionals as well as the entire Navy needed a clear vision of how to organize, integrate, and transform. Thus, "Sea Power 21" was born. "Sea Power 21" is built on the foundation of American asymmetric strengths that are powerful and uniquely ours. Among others, these strengths include the expanding power of computing, systems integration, a thriving industrial base, and the extraordinary capabilities of American power or people. **[Clark-02]**

Three fundamental concepts lie at the heart of this vision: Sea Strike, Sea Shield, and Sea Basing. Sea Strike is the ability to project precise and persistent offensive power from the sea. Sea Shield extends defensive assurance throughout the world and Sea Basing enhances operational independence and support for the joint force.

1. Achieving the Vision

Sea Strike, Sea Shield, and Sea Basing are developed by a supporting triad of organizational processes, Sea Trial, Sea Warrior, and Sea Enterprise initiatives that will align and accelerate the development of enhanced warfighting capabilities for the fleet.

- Sea Trial Impact
    - Fleet-led, enduring process of innovation
    - Accelerated concept and technology development
    - Enhanced headquarters / fleet alignment
- Sea Warrior Impact
    - Continual professional growth and development
    - Improved selection and classification
    - Interactive, web-based, incentivized detailing
    - Networked, high-impact training
- Sea Enterprise Impact
    - Greater process efficiencies
    - Divestment of non-core functions
    - Organizational streamlining
    - Enhanced investment in warfighting capability **[Clark-02]**

The Informational Professional Community has taken the lead in capitalizing on web-enabled technology to promote a life-long continuum of learning. In July 2001, Task

Force EXCEL (Excellence through our Commitment to Education and Learning) was established, which began a revolution in training that complemented the revolution in technologies, systems, and platforms for tomorrow. Task Force EXCEL has since helped to apply information-age methods to accelerate learning and improve proficiency, including advanced trainers, tailored skills training programs, improved mentoring techniques and more effective performance measurement and counseling tools.

Given the same objectives as Task Force EXCEL, the IP community desires to create such a technology within the Sea Warrior realm that will continue to boost professional growth and development.

III. IMPLEMENTATION REQUIREMENTS

A. ELECTRONIC MILITARY PERSONNEL RECORDS SYSTEM (EMPRS)

The Electronic Military Personnel Records System (EMPRS) is the principal information tool used by the Navy Personnel Command (NPC) to manage the Navy's military personnel records. Located in Millington, Tennessee, NPC is the primary and official manager of Navy military personnel records.

EMPRS is an image-based information management tool developed by the EMPRS Program Management Office for processing, storing, and distributing both digital images and ASCII data. To assist in the development of EMPRS, the Navy decided to implement a project, resource and cost management system in order to obtain current project status information, track earned value by activity, project and program, and incorporate the scheduled work, status and cost of different contractor personnel.

The permanent personnel record contains only those documents of a permanent nature, which reflect information that satisfies statutory and corporate requirements, and are essential to personnel administration. Documents that might influence a member's career and benefits are retained while others are deleted. **[EMPRS]**

The first requirement is that the system must interface with EMPRS to allow viewing of the Electronic Service Record data along with image data via a single GUI.

B. NAVY KNOWLEDGE ONLINE (NKO)

NKO was designed to be an indispensable tool in managing and monitoring the sailor's life and career continuum across the entire 5-Vector Model. This 5-vector model is the tool that the Navy will use to identify the knowledge, skills, and abilities that sailors and the Navy need for mission accomplishment. The continuum addresses professional and personal development; professional military education and leadership; certifications and qualifications; and performance as sailors move through the recruit, apprentice, journeyman, and master career phases. This process will allow sailors to precisely map and measure their progress via interactions with NKO.

NKO is designed to impart specific knowledge, and not perpetuate the glut of information available, to the sailor, with targeted data wrapped in context, displayed based on the sailor's roles and identities. Examples of those roles and identities include: rating or designator, rank, communities of interest based on command, collateral duties and watch stations, leadership roles (LPO, LCPO, CMC, DIVO, DH), etc. Channels within NKO are also personalized based on personal interest and membership in a wide variety of communities of interest and communities of practice supported and enabled by the NKO portal. The opening screen for each user includes a customized 5-vector model that the sailor will use to track career growth and development. Data drawn from an individual 5-vector will link to specific information regarding appropriate learning opportunities available across each of the vectors on the 5-vector mode that support both career growth and mission readiness, available in real-time and unique to each sailor. Some data is pushed to the NKO user pages based on specific roles and identities as defined through data filed attributes contained within NTMPS. Other data can be selected, or pulled, by the user when it is needed or is of interest to individuals. For example, announcements in changes of training requirements to an NEC within a rating can be pushed to a targeted audience. Information about upcoming training available to the sailor could be pushed or pulled, depending on the criticality of each NKO user's need to accomplish the training.

Specific content requirements throughout NKO are vast and are expected to continue to grow as the utility of this powerful capability is seen throughout the Navy. Some content will be classified, including operational information, specific command information and some of the rating specific information, procedures, publications, manuals, etc**. [NKO]**

Presently, NKO serves as the forum for IP officers to review and relay information about the IP field. Figure 1 is a snapshot of the web portal for the IP community.

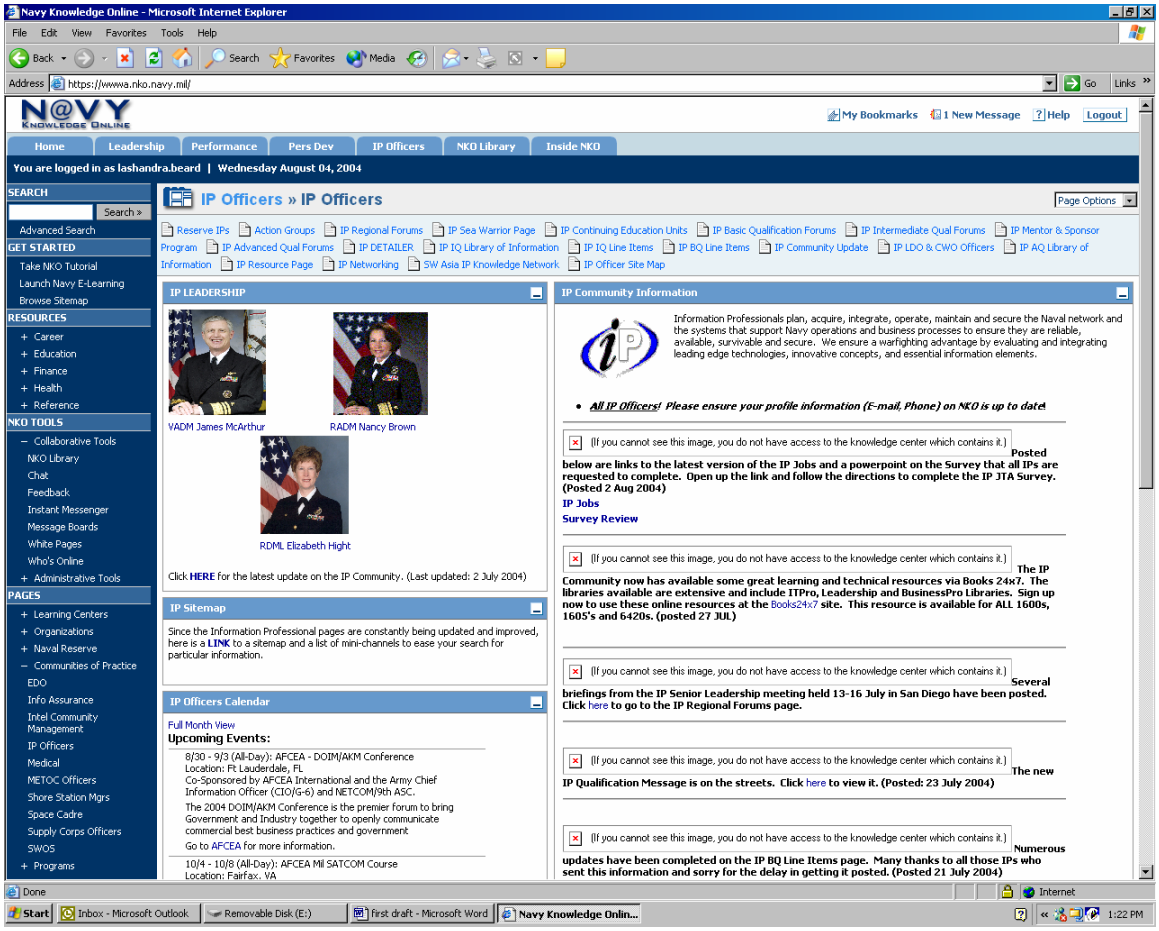

Figure 1. Snapshot of NKO- IP Portal Page. From Ref. **[NKO]**

The second requirement is that the system must be able to be "reached/linked" to NKO. Additionally, upon login of the system, it would also initiate login to NKO. Due to the current content that NKO stores, such as the member's personal info, rank, NEC information, duty station, time in service and other data which has been drawn from the NTMPS database, desired functionally of the new tracking tool is to import the existing user profile from NKO, thus minimizing the customer's reentry of the same information.

C. WEB SERVICES

The presentation of information on the Internet comes in different packages. The three primary presentation modes are web pages, web services, and web portals. A web page can be compared to a picture. It is a snapshot of information at a given time. This currency of information is dependent on the site administrator to stay up-to-date. The web service extends the idea to provide a service. Retail sales sites are web services. The site administrators control the content of the site, but it is designed around a user or customer.

In order to purchase an item from Amazon.com, the customer must establish an account with relevant information. From there, the customer's information, and possibly preferences, is recorded in a database for future use. This allows the site to tailor itself to the user, although it is the administrators who decide how the customer's information will be used and what information will be provided. The site may even have dynamic links to other sites and services incorporated within. Web portals go beyond the idea of just a service. Portals allow the user to define how the site will be designed, choosing what information is desired, and what is not needed.

This section will concentrate on web services, the differences between two, three, and four tier applications, and the advantages of each.

1. Web Services Defined

A web service is a standard approach for making an application available to the outside world. The World Wide Web Consortium (W3C) **[W3C]** oversees web services standards and defines web services as follows.

A web service is a software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format, more specifically the Web Services Description Language (WSDL)). Other systems interact with the web service in a manner prescribed by its description using Simple Object Access Protocol (SOAP) messages, typically conveyed using HTTP with an XML serialization in conjunction with other web-related standards. **[W3C-g]**

Web services are a self-contained, modular application described, published, located and invoked over a network. They are an Internet service that uses the Extensible Markup Language (XML) messaging system, independent of any particular operating system or language. Web services proceed from a human-centric to an application-centric design. **[Cerami-02]**

Some main components of a Web Service are:

- Service Provider – makes the service available.
- Service Requestor – web service consumer.
- Service Broker or Registry – a directory.

- Publish – promoting a service to a registry, allowing it to be discovered and invoked by the requestor
- Find – jointly performed by the requestors and brokers, with the requestor describing what is wanted and the broker delivering the results that best match the request.
- Bind – between the requestor and the provider, allowing the requestor to bind to the service

Web services also support the following attributes: **[Bieter-03]**

- Reusability – based on the ideal of object oriented design, the code for web services are components that can be reused.
- Loose Coupling – the functionality is isolated from the client and accessible only through an interface.
- Discrete Functionality – is self contained and performs a single task.
- Programmatic Access – intended to be accessed by other programs.
- Internet Accessible – accessed over the Internet using standard transport protocols.

a. Two-Tier Architecture

In a two-tier application, the application program runs on the end user's computer (the client) and communicates with the server (i.e., database server, etc.) through a network or modem connection. In a database client/server application, the client can pass SQL statements through a Transmission Control Protocol/Internet Protocol (TCP/IP) connection and if necessary, a database specific protocol (e.g., SQLNet for ORACLE, etc.), to the database. The results are returned to the client machine via the same middleware protocols and are displayed to the user. Figure 2 depicts this scenario.

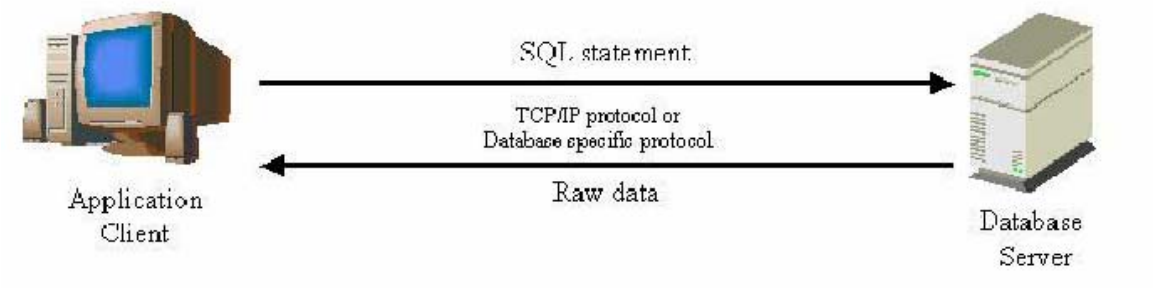

Figure 2. Two-Tier Architecture Diagram. After Ref. **[SYBEX]**

A common error in client/server development is to prototype an application in a small, two-tier environment, and then scale up by simply adding more users to the server. This approach will usually result in an ineffective system, as the server becomes overwhelmed. To scale to hundreds or thousands of users properly, it is usually necessary to move to a three-tier architecture.

b. Three-Tier Architecture

The three-tier interface operates differently than two-tier applications. Similar to two-tier applications, three-tier applications also display information in a GUI. However, in a web interface, the GUI is provided by the web browser that runs on the client machine, as opposed to the GUI being provided by the particular programming language used in a two-tier application. In this scenario, the web server provides an additional layer between the client and the database server. The user specifies a Uniform Resource Locator (URL), which uniquely identifies a particular web server to connect to and a Hypertext Markup Language (HTML) file to view or a program to run on that server. Between the web browser and the web server, TCP/IP is used as the underlying communications protocol (for Internet communications) and the request for the web page is handled by the HTTP protocol which rides on top of TCP/IP. The web server can then interpret the URL and service the HTTP Request. If the request requires database access, the request for data, normally a SQL statement is sent to the database server either using TCP/IP, a proprietary database protocol, or an inter-process communication protocol called Named Pipes. Named Pipes is a protocol within the Windows NT (and UNIX) operating systems that allows processes running on the same machine to communicate with one another. This allows the database server to be configured to not accept TCP/IP communications, thereby making it less vulnerable to exploitations from the network. Once the data request has been serviced, the web server formats the retrieved data into HTML, and sends it to the client machine to be displayed in the browser. See Figure 3 for a diagram of this configuration.

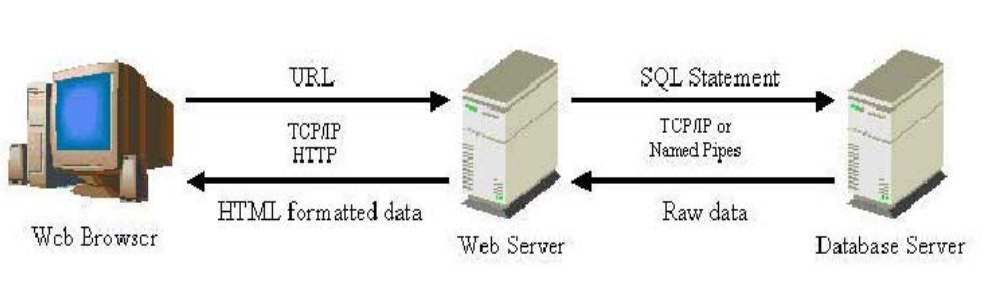

Figure 3. Three-Tier Architecture Diagram. After Ref. **[SYBEX]**

c. Four-Tier Architecture

In the four-tier architecture model, the database server remains the data storage and retrieval mechanism and the application server continues to act as the container for implemented business logic. The presentation server becomes the contact point for the client. All requests and responses originate there. The client can insert a structured XML payload, consisting of commands, data, etc., into the presentation server request, allowing for structured payloads rather than a flat unstructured payload in name-value pairs.

The response sent by the presentation server to the client contains meta-data for the audio and video content. The actual audio and video is still served by systems specifically made to serve those content types, taking advantage of their particular performance tuning. The application server has access to the audio and video content servers to facilitate its interaction with the meta-data of those media types.

The presentation server can communicate with the application server using any combination of naming services and remote interfaces (such as the RMI/JNDI/IIOP combination). This can also be done through a stateless protocol, using HTTP alone, or with a high layer protocol such as SOAP, XML-RPC, etc.

The presentation server will perform one of two actions: a) retrieve cached content and return it to the server or b) send one or more requests to the application server and/or other content servers. If cached content is available and appropriate, it is returned. If cached content is not available, one or more requests are made to the application server, which performs the necessary business logic and returns a response to

the presentation server. The presentation server formats the data received according to the presentation logic, the client device capabilities, its user settings, and content type. This is sent to the client, which retrieves the described content.

The presentation server abstracts all presentation logic from the client and the application server, and sends the appropriate data when it is requested. It performs all presentation formatting before the response is sent to the client. [Review] See Figure 4 for a diagram of this configuration.

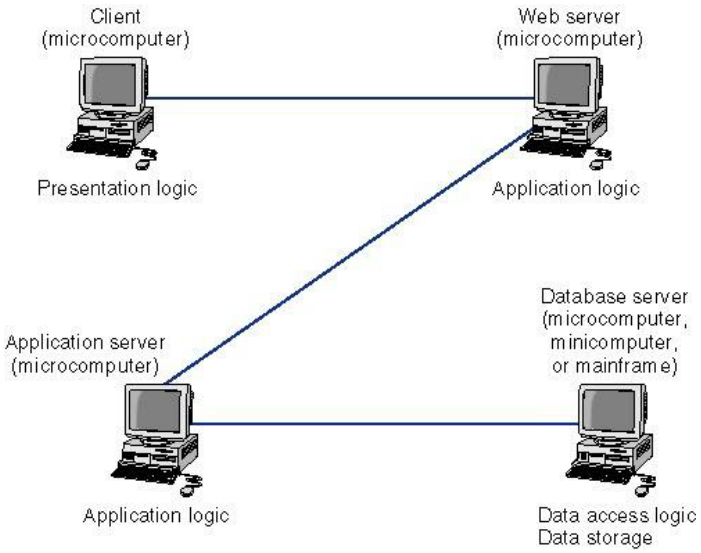

Figure 4. Four-Tier Architecture. From Ref. **[INFRCOM]**

Given all the advantages of the architectures presented, the third requirement is to use either the three or four–tier architecture. Both architectures will satisfy the needs for an effective enterprise information system.

D. NAVY MARINE CORPS INTRANET (NMCI)

The Navy Marine Corps Intranet (NMCI) is a comprehensive, enterprise-wide initiative making the full range of network-based information services available to Sailors and Marines for day-to-day activities and in war. NMCI will give the Navy and Marine Corps secure universal access to integrated voice, video and data communications. It will afford pier-side connectivity to Navy vessels in port. It will also link more than 360,000 desktops across the United States as well as sites in Puerto Rico, Iceland and Cuba.

NMCI will apply the speed and might of world-class Internet technology to everything from administrative tasks to ammunition supply. It will help the Navy and Marine Corps meet these critical objectives:

- Enhanced network security
- Interoperability with CINCs and other Services
- Knowledge sharing across the globe
- Increased productivity
- Improved systems reliability and quality of service
- Reduced cost of voice, video and data services **[EDS]**

Figure 5 was provided by NSIPS to demonstrate its web architecture. Depending on the application developers, this configuration may be different.

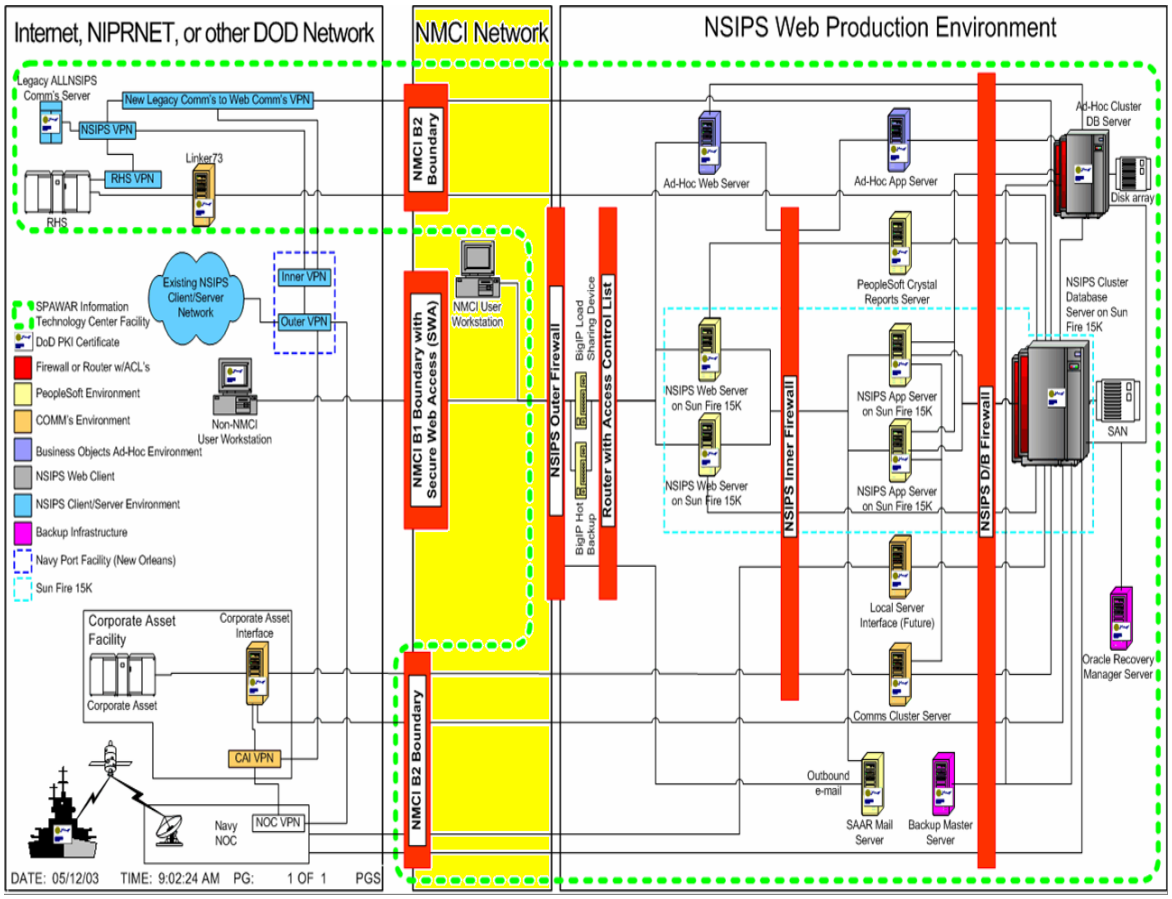

Figure 5. NMCI Network. From Ref. **[NSIPS]**

The fourth requirement is that the product must be deemed compatible within the NMCI environment. Compatibility must meet two simple rules:

- Software and hardware must operate correctly in the NMCI environment
  - No conflicts with Gold Disk load (WIN2K)
  - Good neighbor with other applications
- Software and hardware must not create security vulnerabilities
  - Comply with GPOs
  - No prohibited ports/protocols
    - Inbound anonymous FTP
    - NETBIOS
  - No active code **[NMCI]**

E. 5 VECTOR MODEL (5VM)

The 5 Vector Model (5VM) is a symbol at the core of every Sailor's personal and professional development. 5VM is a powerful concept allowing Sailors to keep track of their careers in the Navy and take credit for their accomplishments. Available at Navy Knowledge Online (www.nko.navy.mil), 5VM is customized to match each Sailor's rating, pay grade and past accomplishments. Every enlisted rating, all officer communities, and Department of the Navy civilians will eventually have a customizable 5VM.

5VM separates the skills and knowledge that Sailors need to be successful into five categories: professional development, personal development, military education and leadership, certifications and qualifications, and performance. **[NKO]**

The 5VM is complex in both its process and structure. Methodically, it is based on the Integrated Learning Environment (ILE) model. The ILE is a way of structuring the Navy's education and training process to link Fleet requirements identification, course design, delivery method, and results tracking and evaluation with individual proficiency requirements (traditionally conceptualized as NECs), systems requirements and capabilities, and knowledge management. The elements of an ILE are the Learning Content Management System (LCMS) and the Learning Management System (LMS)

combined with data housed in NTMPS and the Navy's technical data repository (under construction), and presented through a single access portal, Navy Knowledge Online (NKO).

All entities conspire to create a streamlined process (Human Performance Systems Model) where Fleet entities define requirements and Learning Centers design 5VMs for individual occupations and mission areas, and serve as knowledge managers. Commander Fleet Forces Command will approve all training solutions and individual training commands will deliver training solutions (residency course, computer based training (CD ROM, Internet, LAN), correspondence, on the job training). A fully functional ILE not only streamlines the Navy's education and training process, but also links that process to all peripheral systems, such as compensation, promotion, and duty assignment on the individual Sailor level, and personnel needs and funding throughout the Fleet.

When fully functional, the 5VM will help Sailors determine their professional status, pinpoint career milestones, and identify the skill requirements they need for specific jobs in the fleet. They will also be able to review and compare their career path with alternative routes, view their electronic training jacket, and enroll in online courses.

Another important aspect of the 5VM, which correlates into the required functionally of the web-enabled electronic record, is the Mentor/Protégé match. Currently, this feature allows Sailors the opportunity to ‘request’ mentors, and to be requested as a protégé. Once a mentor is chosen, Sailors have the option of allowing them access to their 5VM. At present, this process is manually accomplished. Figure 6 is a visual representation of the 5VM.

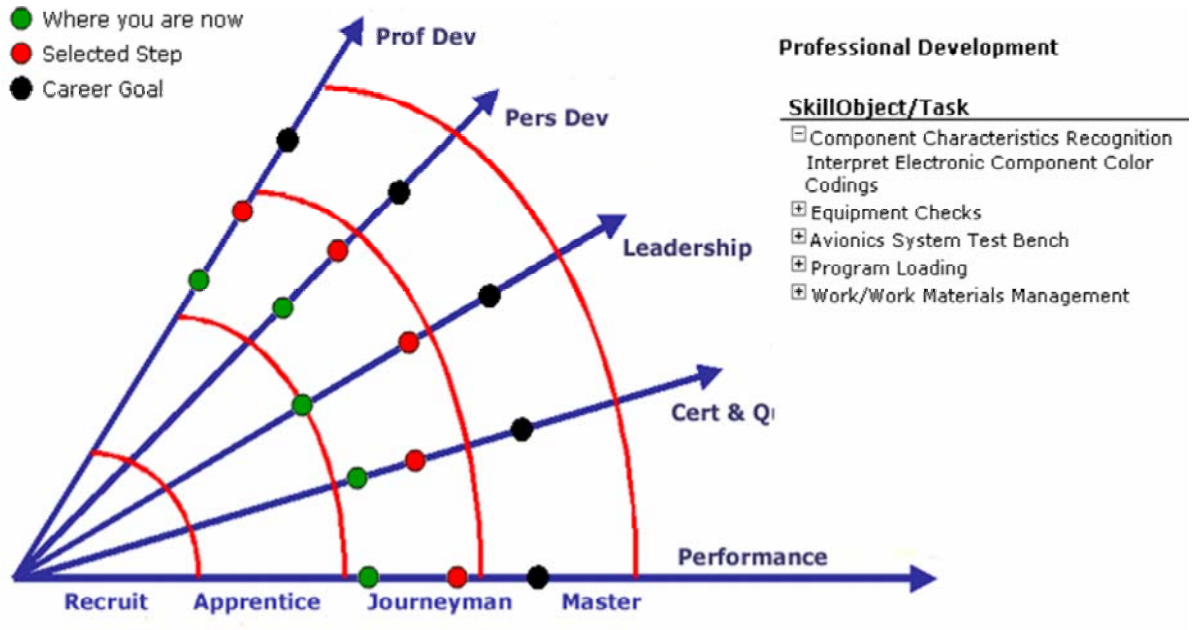

Figure 6. 5VM. From Ref. **[TFW]**

The fifth requirement is that the system must be able to provide qualification data to the 5VM data integration environment. In addition, the vision for the system will be to take the profiles of an IP, and without human, intervention selectively match with a protégé based on the criteria discussed in Chapter III.

F. SEA WARRIOR ARCHITECTURE

The Sea Warrior program implements the Navy's commitment to the growth and development of its people. It will serve as the foundation for warfighting effectiveness by ensuring the right skills are in the right place at the right time. Led by the Chief of Naval Personnel and Commander, Naval Education and Training Command, Sea Warrior will develop naval professionals who are highly skilled, powerfully motivated, and optimally employed for mission success.

Sea Warrior is the personnel, training and education component necessary for Sea Power 21 to succeed. Sea Power 21 envisions a life-long continuum of education and training to match and support advances in technology, systems and platforms. Professional and personal development, leadership and military education will benefit from information technology improvements. Trainers and simulators, skills training, mentoring techniques, performance measurement and counseling will become more effective. The personnel distribution system will become more responsive, interactive and

incentivized to support more informed career decisions. The "goal is to create a Navy in which all Sailors-active and reserve, afloat and ashore-are optimally assessed, trained, and assigned so that they can contribute their fullest to mission accomplishment." **[MAYO-03]**

Figure 7 is an overview of the Sea Warrior architecture and its components. Figure 8 breaks down the technology objectives of Sea Warrior.

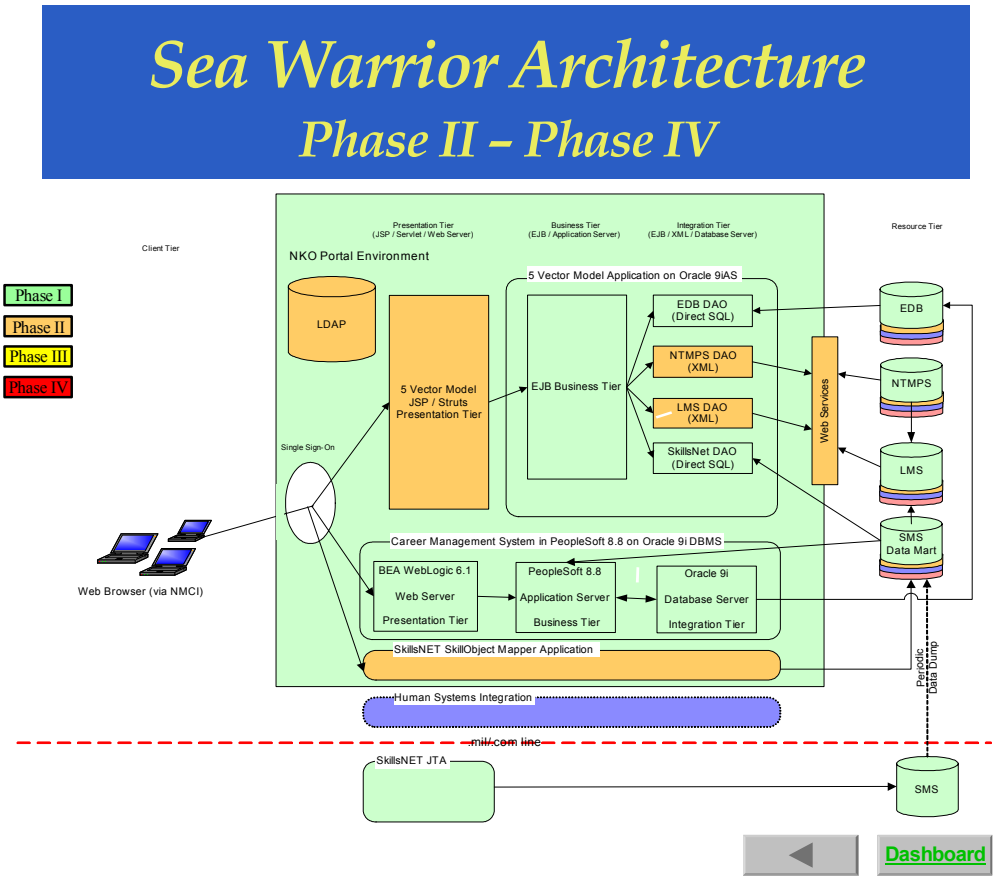

Figure 7. Sea Warrior Architecture. From Ref. **[NSIPS]**

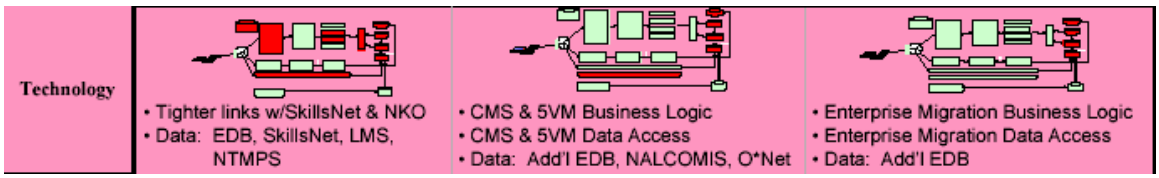

Figure 8. Sea Warrior Program Roadmap. From Ref. **[SW]**

The sixth requirement is for every component utilized for the development, management, and implementation of the automated tracking system to align within the Sea Warrior architecture.

G. SUMMARY OF REQUIREMENTS

In this chapter, I have reviewed the requirements necessary to achieve a fully capable web-enabled interface. The first requirement is that the system must interface with EMPRS to allow viewing of the Electronic Service Record data along with image data via a single GUI. The second requirement is that the system must be able to be "reached/linked" to NKO. Given all the advantages of the architectures presented, the third requirement is to use either the three or four–tier architecture. The fourth requirement is that the product must be deemed compatible within the NMCI environment. The fifth requirement is that the system must be able to provide qualification data to the 5VM data integration environment. The sixth requirement is for every component utilized for the development, management, and implementation of the automated tracking system to align within the Sea Warrior architecture. I believe these six requirements will provide a solid foundation from which the reader may better derive a thorough understanding of this proof of concept model.

IV. ELECTRONIC SERVICE RECORD

A. INTRODUCTION

This chapter will discuss the required and desired functionality of an IP training record application program. The functionality discussed may not reflect all potential capabilities offered by an automated record; however, it will provide an example for further thesis research and prototype development.

B. ELECTRONIC SERVICE RECORD

The Electronic Service Record (ESR) is designed to be a World Wide Web application based on the foundation of the Navy's Single Integrated Human Resources Management Strategy (SIHRS) and basis for the Navy's transition to the Defense Integrated Military Human Resources System (DIMHRS). The goal of the ESR is for this application to be easily accessible using any standard 128-bit encryption browser such as recent versions of Netscape or Microsoft Internet Explorer. The ESR will allow military personnel to access all aspects of that military service member's career in a single, comprehensive record. Once connected to the ESR, the user will have the choice of entering, modifying and reviewing several functions within the record; 1) training, 2) administrative, 3) awards, etc. The ESR will be the web-based management tool for officer and enlisted service records.

C. THE CEU PROCESS

For any level of qualification (BQ, IQ, AQ), the document flow (see Figure 1) starts with the individual. The process itself must be 100% web-based. The use of commercial off-the-shelf software is preferred but not required. Upon logging into the system, the system must also log onto Navy Knowledge Online to retrieve and update the individual's profile.

The CEU process starts when the member applies for CEU credit. The request is selected from a repository of previously approved CEU options. If the requested course is not in the repository, the member will be prompted to provide all necessary information pertinent to the course. Currently, this repository is manually maintained in NKO. However, one of the goals is that once this system is implemented, the 'approved list' will be dynamically updated in both systems. Upon request of an unapproved

course, the request is electronically queued to the Director, Information Professional Center of Excellence (IPCOE) who will be the approving/authorizing authority for all CEU requests via automated notification. Approval/Disapproval will be sent via the same mode to the individual.

When a CEU course has been completed, members will provide "Date of Completion" and the system will generate a completion email alert to IPCOE. Based on the CEU calculation framework provided in the below Section B, #6, the system must provide tracking functionality. Per the framework, if the member has not fully completed their obligatory CEUs, the system will again provide an automatic reminder. Officers who are unable to complete the required number of CEU points due to extenuating circumstances should request a waiver, via letter to the Director, IPCOE, endorsed by their chain of command, prior to the end of the year. Only the major processes are covered in depth. Table 2 represents a complete model of each process. Figure 9 represents the flowchart of the CEU process without the waiver process. Figure 10 is a continuation of Figure 9 which includes the waiver process.

	CEU User requirements:
STEPS	**ACTION**
	Individual enters the following (Provide fields for input):
	a) Name
	b) Rank
	c) Present Duty Station
	d) Contact Number
	e) Email Address
	f) What qualification are you working on (BQ, IQ, AQ).
	Request CEU credit:
	a) Member will request CEU credit. Approved courses will be selected from a drop-down menu (list to be provided by IPCOE)
	i) System needs to Prompt for an additional entry - "Expected date of completion"
	b) Drop-down menu will contain all currently approved courses. Label last option "OTHER".
	i) "OTHER" – when selected, prompts member to submit pertinent information on the course requested to include:
	a. Course title
	b. Course description
	c. Course coordinator phone number
	d. Location of course
	e. Website or email address of course
	f. Commencement date of course
	g. Expected date of completion
3)	**The course selection or "OTHER" data is sent electronically to IPCOE for approval.**
	a) Direct to IPCOE workflow inbox.

4)	**IPCOE approve/disapproves:**
	a) Provide means to show status of CEU request
	i) CEU selection/request received
	ii) CEU approved/disapproved
	iii) A comment section for IPCOE
5)	**Course approval is returned to individual. In addition, attach the appropriate message:**
	a) If BQ - IP Basic requires a minimum (1) approved CEU (10 credit hours aside from those pertaining to achieving qualification). This course must be completed NLT 31 Dec CY.
	b) If IQ- IP Intermediate and above requires 10 approved CEUs. All courses must be completed NLT 31 Dec CY.
6)	**When CEU complete:**
	c) Provide field for input - "Date of Completion" (Members enters date in field)
	d) Email is triggered to IPCOE that individual has completed that CEU
	i. If BQ – send return message to individual "You have completed your CEU requirement for IP Basic. Please retain completion certification for audit purposes"
	ii. If IQ or above – there needs to be a counter to track completed CEUs. Send return message to individual "You have completed (?) of 10 required CEUs. Please retain completion certification for audit purposes
	iii. Provide the option "delete" CEU
	********How to calculate if all CEUs for that level have been completed********
	• **Basic - only 1 CEU is required**
	• **Intermediate or above - 10 CEUs required**
	• **If IQ is completed between Jan-Mar – 10 CEUs required**
	• **If IQ is completed between Apr-Jun - 7 CEUs required**
	• **If IQ is completed between Jul-Sept - 4 CEUs required**
	• **If IQ is completed between Oct-Dec - 1 CEUs required**
7)	**If "Date of Completion" has not been entered by "Expected date of completion"**
	a) Send Automated message to individual via email "We currently show that you requested "NAME OF COURSE" for CEU credit. The expected completion date "EXPECTED COMPLETION DATE" has now expired. If you have completed this requirement please provide the completion date in your electronic record. If you are still working on this requirement, please update the expected completion date. If you no longer are working on this requirement, please update the system enter "delete". CEU credit will not be granted. Please select another CEU"
8)	**On 1 OCT CY, send reminder message to all individuals with blank "Date of completions" that all CEU requirements for appropriate level must be completed by 31 Dec CY. If you are unable to complete requirements by 31 Dec CY, submit waiver request per NAVWARCOMINST 1520.2 NLT 15 Nov CY.**

Table 2. CEU Document Flow

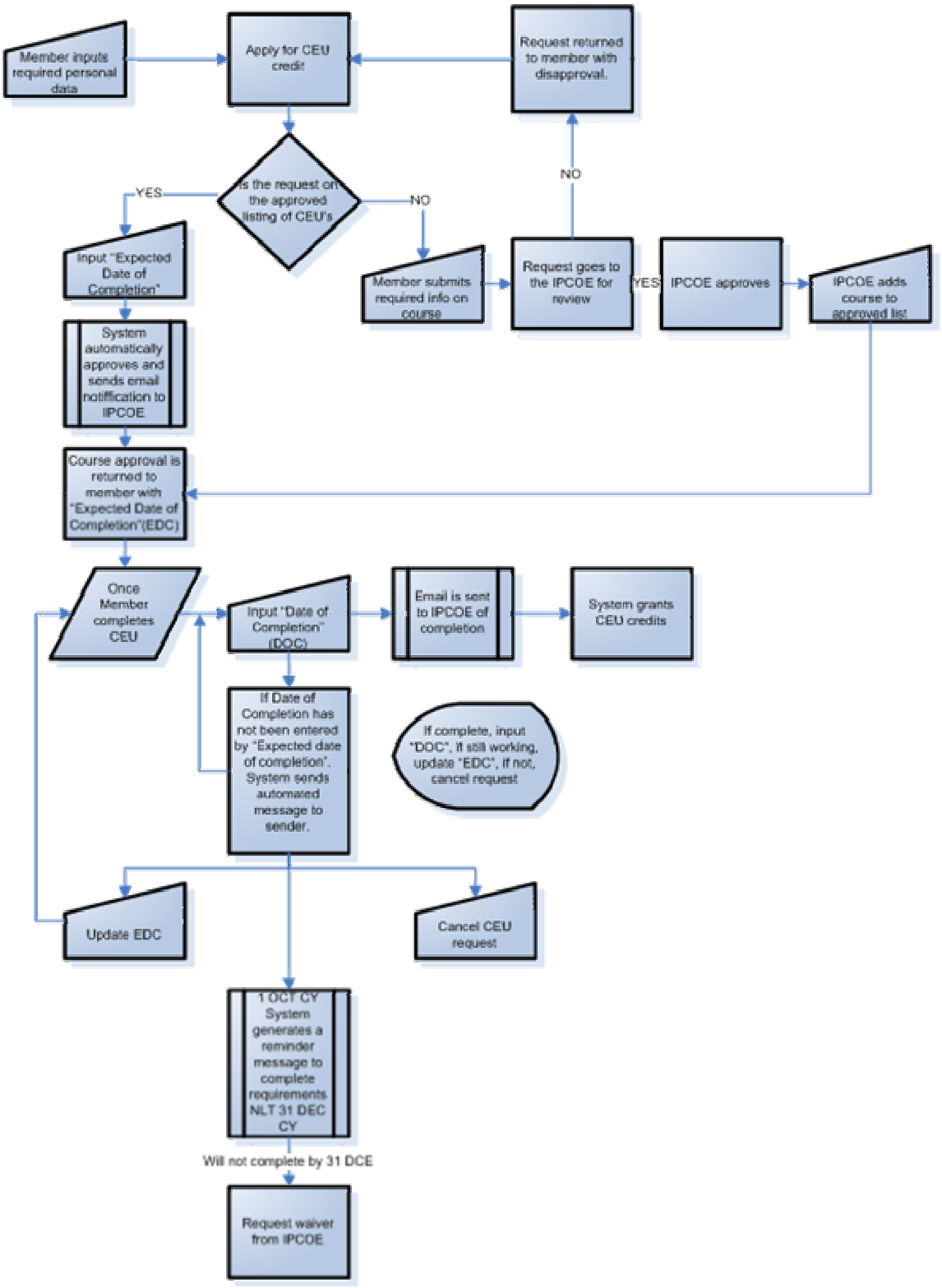

Figure 9. CEU Document Flowchart

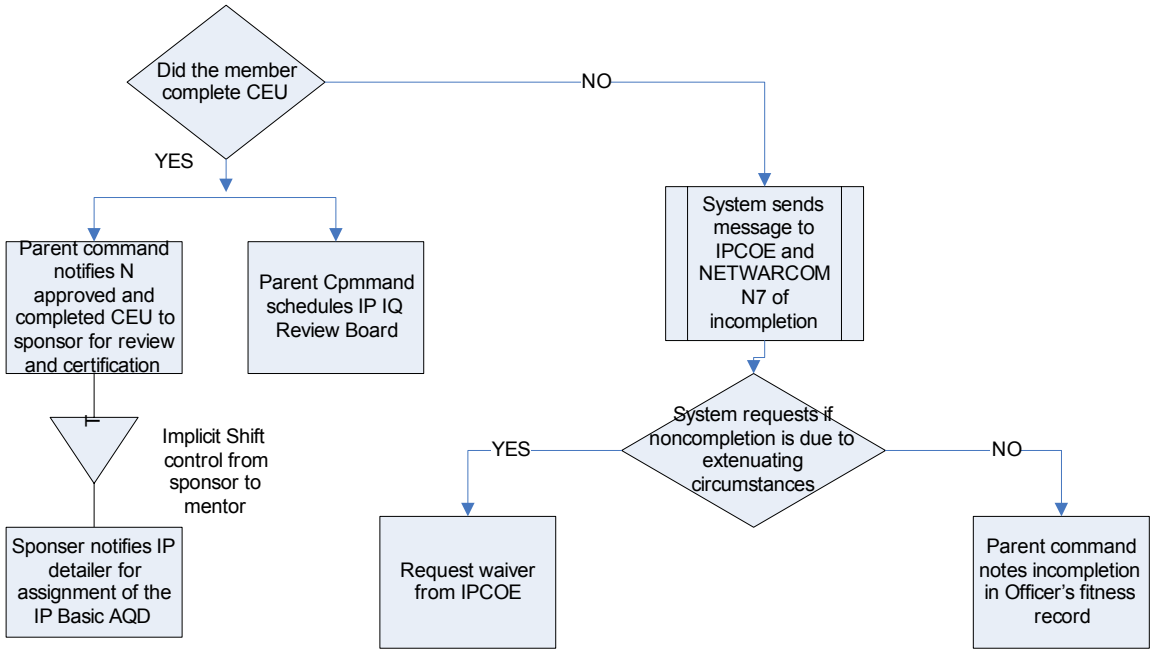

Figure 10. CEU Flowchart with Waiver Process

D. QUALIFICATION PROCESS

To begin the mentoring and qualification process, a 04-Lieutenant Commander IP officer will be assigned to each new IP officer as a mentor. The IP Basic Qualification will serve as a formal introduction to the community and will ensure that all IP officers have an understanding of the IP Learning Continuum and Qualification Process.

The transition from completion of the Basic Qualification to the start of the Intermediate Qualification occurs once the new IP officer selects an IP community Mentor based upon a discussion of personal goals, background, and specialty interests with the sponsor. IP Intermediate Qualification requires each IP officer to achieve proficiency in each mission area module of the IP Intermediate Qualification Requirements. Once the individual has proven such proficiency, they will automatically proceed into Advance Qualification. In addition to completing both Basic and Intermediate Qualifications, members must complete a total of four qualifications/certifications categories detailed in Chapter II, Section A.2. Figure 11 shows the relationship between these three terms.

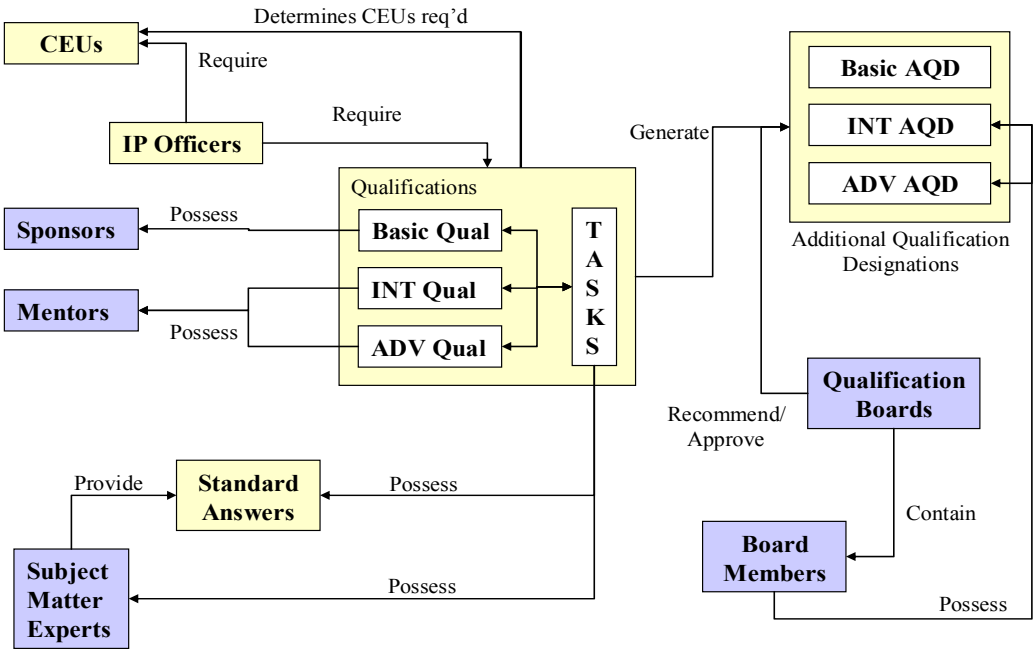

Figure 11. IP Community Qualification Management From Ref. [**Vance**]

E. USER INTERFACE

The user interface will provide the means for NETWARCOM N7, Director, IPCOE, detailer or records custodian to interact with the records database. Although web-base applications have been in existence now for quite some time, it is still a point of concern for many new users. Therefore, the user interface should be relatively straight forward and as "user friendly" as possible, permitting the novice user effortless navigation through a record and or request form.

1. Required Sections

Per the old record system, officer training records were required to contain the following sections:

- Current Letters/Certifications of Designation/Qualifications
- Course completion certificates
- Personal Qualification Standards
- Billet/Collateral Duty Descriptions
- NAVOSH/Safety Training

- In-Service Training
- Ordnance Training (if applicable)

These same requirements must be reflected in the automated record as well. Again, this may not be an inclusive depiction of functional possibilities; however, it does show one possible example using PeopleSoft 8.8 as a design tool. Figures 12-16 are generated screen shots of proposed forms.

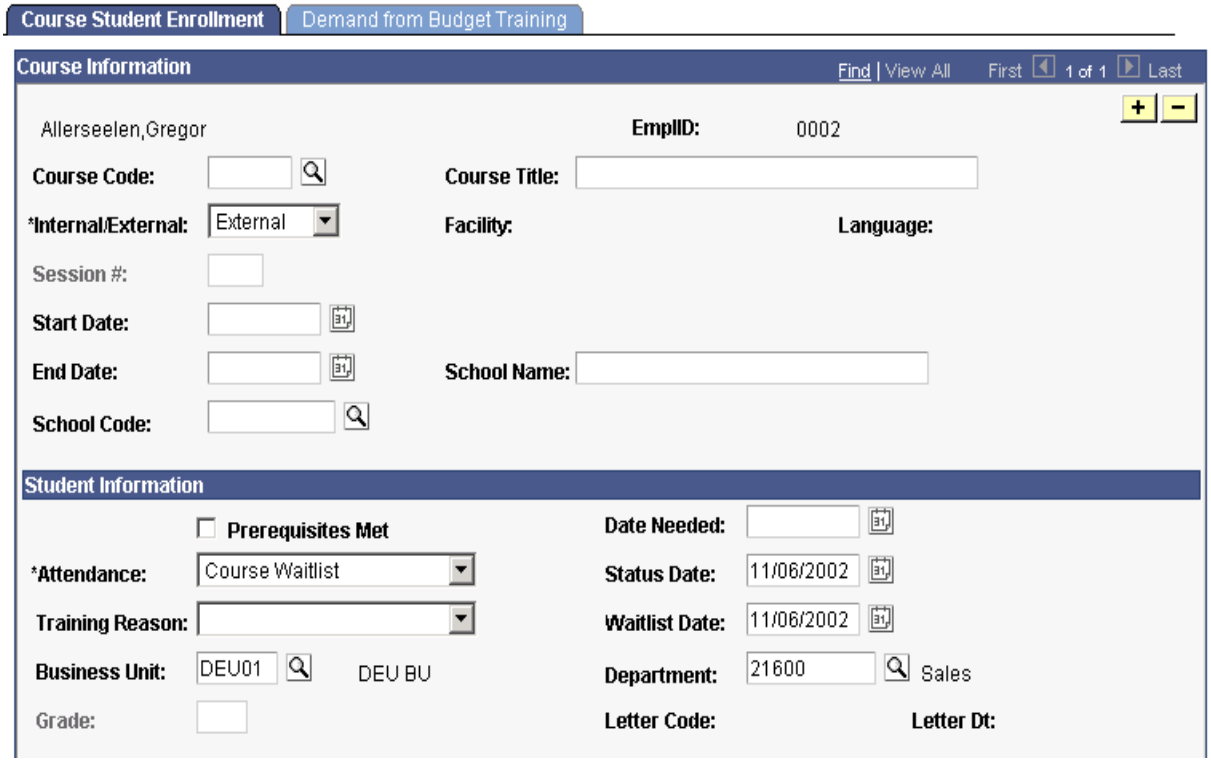

Figure 12. Sample Course Information Section Interface. From Ref. **[PEOPLE]**

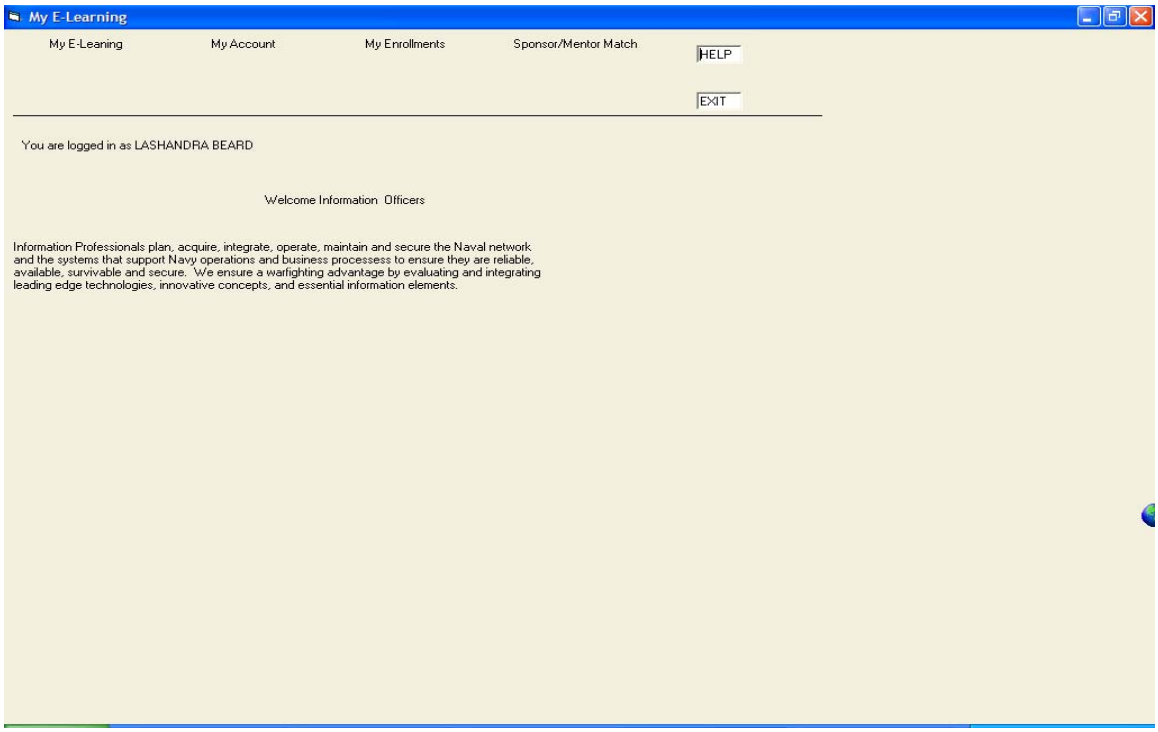

Figure 13. Screen Shot of My_E-Learning Form (Home Page)

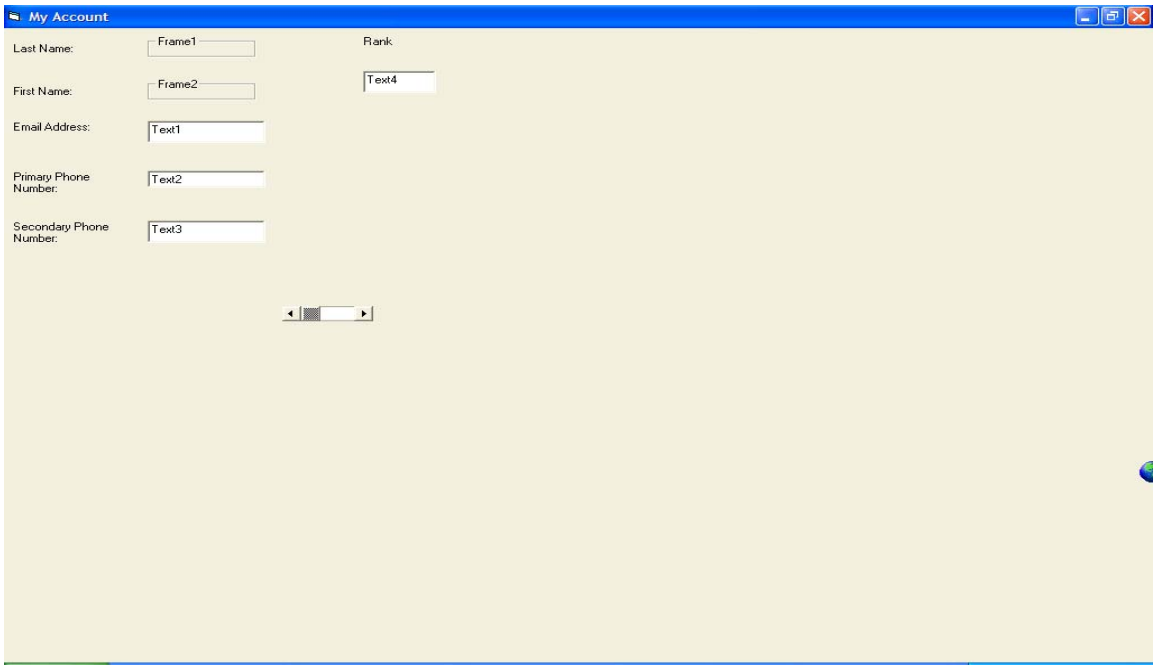

Figure 14. Screen Shot of My_Account Form

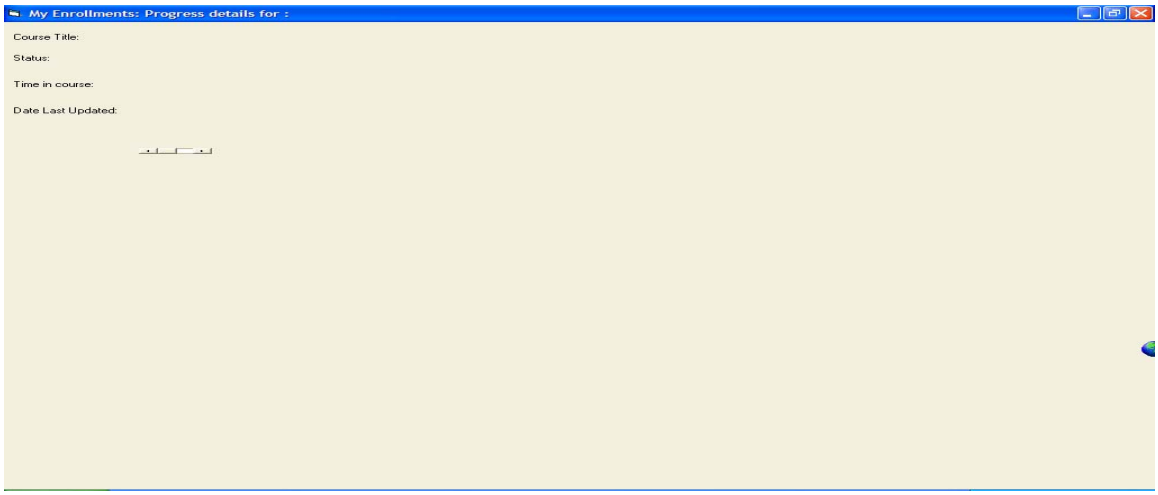

Figure 15. Screen Shot of My_Enrollments Form

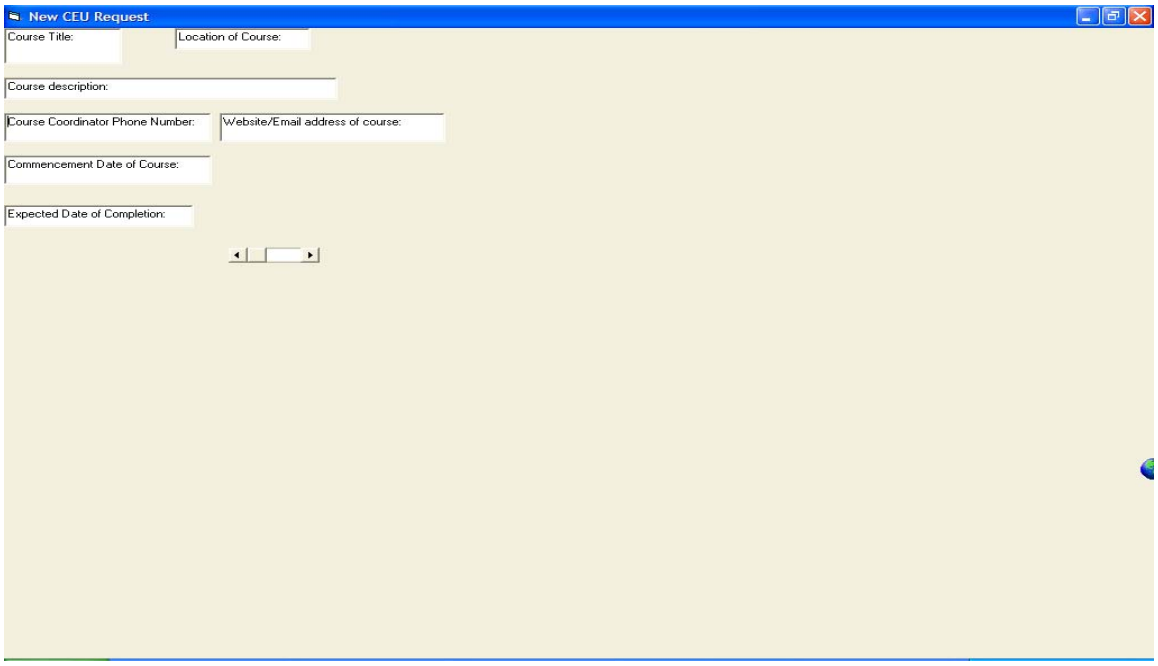

Figure 16. Screen Shot of CEU Request Form

2. Additional Functionality Considerations

Training is a continuous evolution. Initial training starts with the accession of a new officer into the IP community and continues throughout the officer's career. Not only do personnel within that member's command work with the record, but there are several other external personnel that must review, track, and approve documented training. Depending on the effectiveness of these individual persons with regard to

tracking due dates and other essential details, required personnel training may be overlooked until the deficiency is well past the correcting point. To ensure completeness and accuracy, additional functionality requirements must be taken into consideration. However, some of these functionality requirements may pose additional problems. This section will discuss not only required capabilities but also those desired and list possible issues associated with implementation.

a. Automatic Checking

To aid in detecting training, the application should be capable of checking due dates and automatically flag individual records and Director, IPCOE for deficient completion dates.

b. Electronic Signature

The definition of an electronic signature means "a signature in electronic form, attached to or logically associated with an electronic record, that 1) is intended by the parties to signify agreement to a contract or agreement; 2) is capable of verifying the identity of the person using the signature; and 3) is linked to the electronic record in a manner that prevents alteration of the record after signature". Several government agencies, including the House of Representatives have addressed this issue. The House of Representatives bill H.R. 1714, Electronic Signatures in a Global and National Commerce Act, was passed and signed into law by President Clinton on 30 June 2000. The bill's primary goal is to provide for the acceptance of electronic signatures and records in interstate commerce and acceptance by the securities industry. **[Koch-01]**

The use of electronic signatures has called into question whether the method of providing a signature based on preset criteria is indeed authentic. There are several obstacles, although many have been resolved since the signing of the H.R. bill, that still plague society. These obstacles include compatibility and security.

Compatibility and security are the most integral parts of the electronic signature process. Although e-sign itself does not require authentication, it is a requirement for commercial acceptability. The problem is not the lack of authentication

products but that the various products available are incompatible with one another. Issues such as email systems and web servers not being able to recognize certain digital certificates continue to exist.

Beyond compatibility, the different authentication methods require secure environments to ensure validity. Authentication software allows anyone to pose as a potential imposter. Is it always possible to ensure that the actual sender is indeed the sender?

There are two categories of security: non-cryptographic and cryptographic. The types of non-cryptographic methods available are 1) personal identification number (pin) or password, 2) smart card, 3) digitized signature, and 4) biometrics. Each of these methods relies on software linked to the specific application that the user is trying to access. The types of cryptographic methods available are 1) Shared Symmetric Key Cryptography and 2) Public/Private (asymmetric) Cryptography or Digital Signatures. The use of cryptographic methods allow the use of multiple functions because they are not tied to a specific application and can provide both authentication and encryption services.

E-signatures will be required from both internal and external sources. The use of a non-cryptographic method will be used in the form of an Electronic Qualification card. The Electronic Qualification card will include personal identifying information such as name, rank, and duty station plus some sort of identification code (i.e., lineal number, billet number, etc.) excluding SSN. Nevertheless, the risk of sabotage is still present and caution must be taken by both sides to ensure that all agencies select a security system based on the risk of the application and consider all available electronic signature technologies as part of their assessment.

What steps should agencies follow to ensure that electronically-signed records are trustworthy? To create trustworthy records with electronic signatures, an agency should:

- Create and maintain documentation of the systems used to create the records that contain electronic signatures.
- Ensure that the records that include electronic signatures are created and maintained in a secure environment that protects the records from unauthorized alteration or destruction.
- Implement standard operating procedures for the creation, use, and management of records that contain electronic signatures and maintain adequate written documentation of those procedures.
- Create and maintain records according to these documented standard operating procedures.
- Train agency staff in the standard operating procedures.

Table 3 provides the requirements for the Electronic Qualification Card.

	Requirement for Electronic Qualification Card/Electronic Signature
a)	Signature Capability – must be secure
b)	Card must include pertinent information on the individual to include:
	i. Name
	ii. Rank
	iii. Duty Station
	iv. Some sort of identification code (i.e. lineal number, billet number, etc.)
c)	No SSNs
d)	All Line Items and sub-Line Items for signature
e)	Read/Write access:
	1. Individual – Read
	2. SME – Read/Write access for specific/designated Line Items
	3. Mentor/Sponsor – Read to specific mentoree
	4. NETWARCOM Training – Read/Write
	a. Admin rights to monitor, add SMEs to approved list, add lateral/WOBA/direct accession IPs
	b. NETWARCOM must be able to continuously monitor user status to see where the individual is in the qualification process (i.e. He/she has completed 53% of their IQ.)
	5. Reports
	a. BQ/IQ/AQ completion certificates
	b. BQ/IQ/AQ progress reports
	c. SME breakdown of which quals they have participated in

Table 3. Electronic Signature Requirements. From Ref. **[Pressiler]**

c. Global Synchronization

Once members have logged on, the system should be able to pull/link user information from other parts of the electronic service record to help complete any required forms. The key to establishing and maintaining accurate and consistent information within and between an organization and its partners/customers is global synchronization. Partners for the purposes of this thesis include but are not limited to the Navy Standard Integrated Personnel System (NSIPS), the Navy and Marine Corp Intranet (NMCI), the Internet, EMPRS, Navy Knowledge Online (NKO) and other DoD

networks. Customers for the purposes of this thesis include but are not limited to NETWARCOM, detailers, the Director of IPCOE, SMEs and individual service members.

Global synchronization consists of three goals: internal synchronization, external synchronization, and ongoing synchronization. Internal synchronization is the process of ensuring that all the information for synchronization is consistent and accurate. It consists of three steps: finding the data to synchronize, controlling and coordinating information changes, and cleansing the information.

Goal two is external synchronization. Once all the data within the organization is synchronized, the next step is to synchronize with the partners/customers. This step consists of three steps: comparing the user's and the partner's two versions of "the truth": identifying and reconciling any exceptions found, and updating any erroneous systems with correct values.

Goal three is ongoing synchronization. This final phase launches an ongoing process by which the user and partners will stay in sync over time. There are several key functions both parties must launch: extract and aggregate, detect changes, route and review, create and send, monitor and react, and update internal data. [DS]

d. World Wide Web Accessible

Alternative access should be permitted by an authorized user via the WWW. Designing a well-organized Web site helps visitors navigate through the information presented. A few simple but mandatory rules are discussed below.

(1) Maintain a Simple, Consistent Page Layout throughout the Site. A consistent design and look makes it easier for visitors to locate the specific information sought. For example, a feature presented on every page, such as a standard navigation menu or logo for the site, should always appear in the same place. A clear, consistent presentation will especially assist people with visual impairments or learning disabilities who have difficulty using disorganized navigation schemes. **[Comden]**

(2) Keep Backgrounds Simple. Make sure there is enough contrast. People with low vision or colorblindness, or those using black and white monitors, can have difficulty reading information at sites with busy backgrounds and

dark colors. Some background images and colors obscure text and make reading difficult. Ensure enough contrast between the text and the page's background. Choose background, text, and link colors carefully, and always test the site by viewing it at different resolutions and color depths. For example, it is possible to change the monitor settings to a resolution of 640x480 and 16 colors for one test, and change to 1024x768 and 24-bit color for another**. [Comden]**

(3) Use Standard XML/HTML. XML is a markup language for documents containing structured information. Structured information contains both content (words, pictures, etc.) and some indication of what role that content plays (for example, content in a section heading has a different meaning from content in a footnote, which means something different than content in a figure caption or content in a database table, etc.). Almost all documents have some structure. **[Walsh]**

XML specifies neither semantics nor a tag set. In fact, XML is actually a meta-language for describing markup languages. In other words, XML provides a facility to define tags and the structural relationships between them. Since there is no predefined tag set, there cannot be any preconceived semantics. All the semantics of an XML document will either be defined by the applications that process them or by style sheets.

Hypertext Markup Language (HTML) is the standard code used to create websites. HTML was designed to be a universal format outside the bounds of proprietary software and computer operating systems. The code works via tags that tell a web browser where to find and how to display information. While nonstandard tags exist, using standard HTML as defined by the W3C will ensure that the content can be accessed by all browsers used by visitors to the site. **[Comden]**

Although both codes are suitable for this application, the preferred code for this application is XML due to its richly structured documents. HTML, as already discussed, comes bound with a set of semantics and does not provide arbitrary structure.

(4) Make Links Descriptive So That They Are Understood Out of Context. Visitors who use screen reading software can adjust their software to read

only the links on a page. For this reason, links should provide enough information when read out of context. Use a more descriptive phrase than "click here" as a link or next to a graphic used as a link**. [Comden]**

(5) Include a Note about Accessibility. Notify site visitors of concerns about accessibility by including a web access symbol on the page. Include a statement about accessibility and encourage them to send a notification of any accessibility concerns. **[Comden]**

e. Mentor Match

A tool is needed that will take IP profiles and match them with a mentor. It is important to understand that several types of mentoring exist such as natural mentoring, situational mentoring, supervisory mentoring, and formal facilitated mentoring. This thesis will implement the formal facilitated program. Formal facilitated mentoring programs are structured programs in which an organization matches mentors with protégés. They also target one special segment of the organization whose career development may be lagging behind that of others (for example, women) to help that group advance further. They may assign mentors to protégés and monitor the progress of the mentoring connection. In this case, mentors will be assigned once individuals have completed the BQ qualification**. [NKO]**

General guidelines for the mentoring process are:

- Protégés
  - Keep it out of the chain of command
  - Try for a two grade level difference
  - Look for someone at or near the command
  - Candidate must be qualified at the next level for which qualification is sought
- Mentors
  - Commit to a one-year partnership
  - Discuss "no-fault" termination
  - Have a six-month check-up [NKO]

An effective mentoring program is designed to benefit both the mentor and the protégé. An element of trust must be developed in order to optimize the benefits of mentoring. Keeping this in mind, the following provides the basic roles for mentoring.

- Identify the career goals of the protégé
- Provide advice and guidance on career development opportunities
- Encourage the protégé to develop to the fullest, both personally and professionally
- Assist the protégé in developing and charting his/her career path
- Share own insights on broad IP missions and functions, as well as an awareness of the programs and activities that fall within the scope of the mentor's responsibility.

The recommended process for mentor/protégé match is as follows:

- Step 1 –The Mentor Program via Web-Based system
  - Notifies the mentor and protégé of the match
  - Provides contact information to both parties
- Step 2 – The Mentor via Web Based system
  - Sends an introduction e-mail to the protégé
- Step 3 - The Protégé
  - Initiates contact with the mentor

Table 4 provides the requirements for the Mentor Match program.

	Mentor Match
a)	Must have a vehicle that will take profiles of the IP and match with a mentor.
	a. Geographic location must be taken into account to ensure that the mentor is not within same chain of command
b)	Program must be browsable.
c)	Contact information must be in the program.
d)	Must be an area where the matching can actually take place.

Table 4. Mentor Match Requirements. From Ref. **[Pressiler]**

F. RISK MANAGEMENT AND COST ANALYSIS

1. Assessing Risk, Costs, and Benefits

Before implementing any system, a risk management and cost analysis should be done to determine what risks, if any, are associated with implementation and if there are risks involved in how much it will cost to fix or maintain an acceptable level. The top priority to evaluate in converting from paper forms to a web-based application is 'is it possible to minimize the cost to the government while enhancing the benefits to both the

government and the public (contractor)'. The ability to conduct a good risk assessment is directly related to data used in conducting the assessment. There are several approaches to conducting a risk analysis: quantitative risk analysis, relative risk analysis, and hazard analysis. Quantitative risk analysis incorporates numerical estimates of frequency or probability and consequence. In practice, a sophisticated analysis of risk requires extensive data, which are expensive to acquire or often unavailable. Fortunately, few decisions require sophisticated quantification of both frequency and consequences. Relative risk analysis means that a risk is evaluated in comparison to another risk. The type of risk analysis used should be appropriate for the available data and to the exposure, frequency and severity of potential loss. Hazard analysis is the identification of material properties, system elements or events that lead to harm or loss. The term hazard analysis may also include evaluation of consequences from an event or incident. The type of approach examined will be relative risk analysis. **[Jennimgs-00]** Figure 17 represents a relative risk analysis.

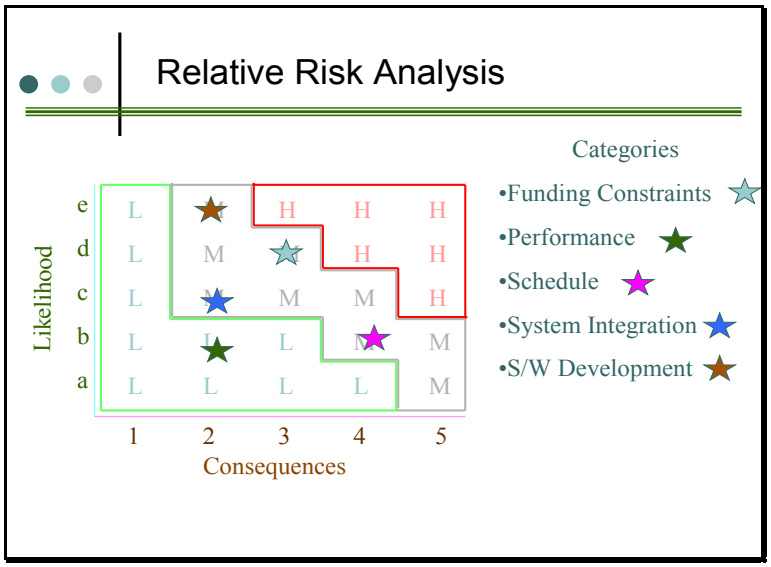

Figure 17. Organization Risk Management Chart

Relative risk analysis focuses on the possible location of resources for a particular risk event based on that risk rating. The risk data is based on 1) the likelihood that an event will occur and 2) the effects (consequences) of an event occurring.

The cost-benefit analysis is done to determine if the system is cost effective. To determine the true cost of the conversion to an electronic system, the cost of the system hardware, software, administrative, and system support will be factored into the calculation. Several issues can affect cost benefit analysis: 1) what is the overall timeline for completion of the project 2) will this be a new system generation or will the system be implemented using existing COTS software and 3) are special features such as electronic signatures required. A cost analysis for this type of system has already been conducted by Lockheed Martin Integrated Systems, Inc. The figures presented represent the cost for the modification of a COTS application (PeopleSoft), which is already being used for the Navy's electronic personnel record in addition to hardware, software, administrative support, and other crucial system support elements such as electronic signature and the mentor match program. Table 5 is a detailed cost analysis of labor charges provided by NSIPS.

SCHEDULE 3 - LABOR SUMMARY **Encore IP Certification & Qualification ROM**				
Cat	**Labor Category Description**	Base Year: 10/01/03 - 9/30/04		
		Hours	**Rates**	**Total Price**
G01	Task Order Project Manager (Key)	290	$99.88	$ 28,964
G02	Quality Assurance Manager	50	$52.92	$ 2,646
G06	Senior Functional Analyst	1,100	$66.66	$ 73,329
G08	Principal Systems Architect (Key)	200	$81.27	$ 16,253
G14	Junior Computer Systems Analyst	50	$33.95	$ 1,697
G16	Applications Engineer	100	$48.54	$ 4,854
G44	Technical Writer/Editor	100	$38.71	$ 3,871
G81	Systems Environment / Tools Expert (Level B)	750	$122.19	$ 91,639
G82	Systems Environment / Tools Expert (Level C)	550	$91.49	$ 50,319
Total		3,190		$ 273,573

Table 5. Cost Analysis. From Ref. **[NSIPS-04]**

2. Risk Factors

When evaluating the risk of implementing an electronic record system, the agencies need to first view the relationship between the parties involved in the transaction. There are five general categories used to evaluate the relationship risk: 1) global risks that would or could impact the organization and similar organizations, 2) risks within and outside someone's span of control, 3) risks associated with activities

conducted outside the premises, 4) risks associated with outsourced or contracted services, and 5) risks associated with the use of goods and services by external organizations. Risk tends to increase when moving from intra-agency to inter-organizations. [Jennings-00]

How is risk identified? There are many methods of risk identification. Whatever the method, ensure that it enables a comprehensive identification of risks, as unidentified risks cannot be planned for and treated.

It is critical in the identification of risk that two key elements of actual or potential exposure be identified, namely:

- the cause of an exposure (i.e., failure of…, lack of..., loss of..., injury to....)
- the effect of the exposure. The effects may include financial impact, impact on staff, and other stakeholders, impact on reputation and probity, impact on operational management and impact on the delivery of programs

The following categories were identified as producing the leading risk: software development, funding constraints, system integration, schedule, and performance in order of magnitude. The likelihood of software development concerns is highly likely. Understanding the requirements and needs of one community is complex, but establishing the requirements for the fleet would require extensive processes to be examined, modified and re-tested in some instances provided a current system is in place. Funding would prove to be more of a directive challenge than a resource challenge. Establishing who would pay the cost of such a sophisticated system entails a decision that must be made from a DoD perspective rather than 'one community' making the decision. Chapter IV expounds on the system integration issues.

Provided accurate requirements are submitted, the estimated timeline to perform a fit-gap analysis and design is estimated for a period of 116 business days after contract award date. Table 6 shows the exact days to perform each milestone.

Perform Fit-Gap Analysis and Design			
1	Requirements Review with PMO	20 days	CA + 20 days
2	Requirements Review with Customer	5 days	CA + 25 days
3	Requirements Document Officially Delivered to PMO	5 days	CA + 30 days
4	Design Review with PMO	20 days	CA + 50 days
5	Design Review with Customer	5 days	CA + 55 days
6	Design Document Officially Delivered to PMO	5 days	CA + 60 days
7	Development	25 days	CA + 85 days
8	Unit Testing	10 days	CA + 95 days
9	System Testing	20 days	CA + 115 days
10	Deliver Software to PMO	1 day	CA + 116 days

Table 6. Fit-Gap Analysis and Design. From Ref. **[NSIPS-04]**

3. Cost and Benefits Factor

Most agencies in the Federal government are not involved in generating revenue, but are focused on investments allowing them to provide service at a reduced cost. Measuring the costs of an electronic service is much easier than the benefits. Costs are normally fixed such as hardware/equipment, software, labor for installation, and system infrastructure.

The benefit side is not so easily recognized. Improving customer service, not generating revenues, is the driving force for most conversions since benefits are subjective in nature. A list of benefits is: 1) improving the ability to deliver a service on customer requests, 2) improving access to information, 3) improving access to a service, 4) improved accuracy and speed of transaction, 5) improved compatibility between government agencies, 6) improved effectiveness and efficiency of government agencies, 7) improved security of information, and 8) improving the ease of use to the public. **[Jennings-00]**

Agencies need to review the processes currently used before beginning the conversion process. Taking old processes and moving them to the web can achieve some benefits. However, reengineering the business process before the conversion is made to the electronic media format is the best method to use to achieve the highest rate of return.

G. CHAPTER SUMMARY

At this point we must ask, "Does this proposal fully address the requirements set forth in the previous chapter? And what are the features that we want this technology to provide?" From this perspective, one determines that we need

- A reliable technology that's robust and trustworthy
- A technology that is cost effective
- A technology that provides the needed level of security
- A technology that provides the flexibility to adjust to different environments
- A technology that provides efficient data access, data independence and data integrity

A significant issue in the design of any product is the selection of the tools to use. When choosing the right tool, consideration must be given to the skills of the personnel who will be using the system as well as the general purpose of the system itself. Tools such as automatic checking, electronic signature, global synchronization, WWW accessibility, and mentor match capitalize on the existing web browser technology and the Internet. By combining the requirements set forth in Chapter III and the features selected in this chapter, the probability of building and maintaining a comprehensive CEU and qualification tracking system for the IP community is highly achievable.

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V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

At the outset of this thesis, the goal was to create a usable working prototype for the IP community. That prototype would revolutionize how training was conducted and reported in the U. S. Navy. It was to be a standard example of the application of technology to make a business process more efficient. The result is a working proof of concept that is regarded as a good first step and will become the impetus for implementation. The data model and the discussion points will be the basis for a follow-on project that will build on this prototype and carry it through the pilot test program and fault testing. The follow-on thesis will decide upon the best vendor to choose to migrate the data model, clarify the concern of who will fund the project as well as provide specific guidance to the functional requirements needed for each community.

The mindset that documenting training of this type is important yet time consuming remains entrenched in many sailor's minds. The training process is a continuous evolution. Personnel in the IP community are required to receive periodic and refresher training, which needs to be documented in their individual training record. Due to the elimination of the OFSR, the requirement of developing an automated mechanism to input and track CEU and qualification data is essential.

Automating training records will alleviate or even eliminate some hardships associated with paper records. Standardization, decreased data entry workload, portability, increased record availability, and access control are all important benefits of automation. Synchronization will provide a method of updating information contained in the individual databases to ensure data consistency and integrity of all databases in the system. To the end user, the system will look and feel like a centralized system, with much of the transactions being transparent. A "user friendly" standard application interface should allow even the novice computer user's effortless access to the record.

In time, a web resource of this type will become the standard for personnel administration and any subsequent changes to this archetype will be a paradigm shift away from which a future generation of change agents will have to overcome.

B. RECOMMENDATIONS FOR FUTURE WORK

Due to funding concerns, this project was halted; however, much of the preliminary work has already been researched by NSIPS. The first suggestion is to conduct an extensive financial analysis as to the division of financial responsibility amongst the different communities. Considering that the realm of this project is enfolded by Sea Power 21, research the applicability of receiving additional funding through this source.

The second suggestion is to return to NSIPS to begin implementation of the web-enabled system. Initial requirements sent as of July 2003 have been reviewed and validated by NSIPS and Lockheed Martin Integrated Systems (LMIT).

The third suggestion is to build this application from scratch using Naval Postgraduate students and fully customize it to the IPs community requirements as set forth in this thesis and modify as necessary.

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